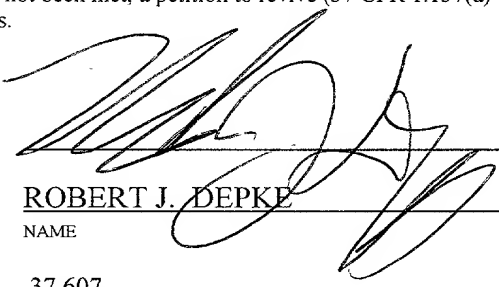


page 1 of 2

(July 1998)

U.S. APPLICATION NO (if known, see 37 CFR 1.5) <div style="text-align: center; font-size: 1.2em; font-weight: bold;">09/719594</div>		INTERNATIONAL APPLICATION NO <div style="text-align: center;">PCT/EP 00/02509</div>		ATTORNEY'S DOCKET NUMBER <div style="text-align: center;">00694635</div>	
17. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... \$1070.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... \$930.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$790.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$720.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$98.00 <div style="text-align: right;">ENTER APPROPRIATE BASIC FEE AMOUNT =</div>				CALCULATIONS PTO USE ONLY	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	6 - 20 =	0	x \$22.00	\$	-
Independent claims	1 - 3 =	0	x \$82.00	\$	-
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$270.00	\$	
TOTAL OF ABOVE CALCULATIONS =				\$	930.00
Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).				+	\$
SUBTOTAL =				\$	930.00
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				+	\$
TOTAL NATIONAL FEE =				\$	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property				+	\$
TOTAL FEES ENCLOSED =				\$	930.00
				Amount to be refunded:	\$
				charged:	\$
a. <input checked="" type="checkbox"/> A check in the amount of \$ <u>930.00</u> to cover the above fees is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>13-0019</u> . A duplicate copy of this sheet is enclosed.					
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO					
Robert J. Depke MAYER BROWN & PLATT P. O. BOX 2828 CHICAGO, ILLINOIS 60690-2828 (312) 701-8786					
 ROBERT J. DEPKE NAME <u>37,607</u> REGISTRATION NUMBER					

IN THE UNITED STATES RECEIVING OFFICE PCT

IN RE: APPLICATION OF:

GROUP ART UNIT: Not Yet Assigned

Frank KUEHNEL and  
Wolfgang WARNKE

EXAMINER: Not Yet Assigned

APPLICATION NO.: PCT/EP 00/02509

INTERNATIONAL FILING DATE:

March 22, 2000

FOR: ELECTRONICALLY CON-  
TROLLED ELECTRIC MOTOR  
INTENDED FOR USE IN AN  
ENVIRONMENT WITH  
SOLVENTS

## CERTIFICATE OF MAILING BY "EXPRESS MAIL"

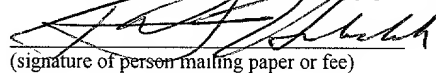
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BOX PCT

Assistant Commissioner for Patents  
Washington, D.C. 20231PRELIMINARY AMENDMENT

Sir:

In the above referenced application, prior to examination, please amend the application as follows:

IN THE SPECIFICATION:

On each page, please delete the top line comprising: "4178 PCT"

On page 1, lines 1-5, replace "Description" and "Electronically controlled electric motor intended for use in an environment with solvents" with the following:

--

SPECIFICATION

Title of the Invention

RECEIVED "THE PATENT OFFICE"

ELECTRONICALLY CONTROLLED ELECTRIC MOTOR

INTENDED FOR USE IN AN ENVIRONMENT WITH SOLVENTS- -

On page 1, after line 5, insert:

- - Background of the Invention

Field of the Invention - -

On page 1, after line 11, insert:

Description of the Related Art - -;

On page 1, after line 36, insert:

- - Summary of the Invention - -

On page 3, after line 28, insert:

- - Brief Description of the Drawings - -

On page 3, after line 37, insert:

- - Detailed Description of the Presently Preferred Embodiments - -

On page 3, last line, delete "a", first occurrence.

Please replace claims 1-6 with the following new claims:

1. An electronically controlled electric motor comprising:

at least one rotor bearing permanent magnet and a stator having coils; wherein motor position sensors for ascertaining a commutating time are arranged in the stator; at least one position sensor having an electrical conductor in which a current is induced by a moving magnetic field to generate a signal in the electrical conductor and which is produced integrally with connecting leads.

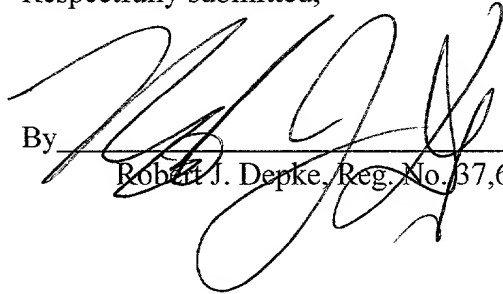
2. The electric motor as claimed in claim 1, wherein the connecting leads of the position sensor are led to a solvent-free space.
3. The electric motor as claimed in claim 1, wherein the electrical conductor is a coil.
4. The electric motor as claimed in claim 1, wherein the electrical conductor is a pulse wire arranged transversely with respect to movement of magnet poles of the rotor.
5. The electric motor as claimed in claim 1, wherein the rotor has position magnets arranged away from its permanent magnets and opposite the position sensor.
6. The electric motor as claimed in claim 1, wherein the rotor has a disk which is arranged away from its permanent magnets and is in operative connection with the position sensor and has independently magnetized regions.

REMARKS

Applicants respectfully request entry of this amendment prior to examination of this application.

Respectfully submitted,

By



Robert J. Depke, Reg. No. 37,607

Date: December 13, 2000

MAYER, BROWN & PLATT  
P.O. Box 2828  
Chicago, Illinois 60690-2828  
312/701-8786

DescriptionElectronically controlled electric motor intended for  
use in an environment with solvents

5

The invention relates to an electronically controlled electric motor intended for use in an environment with solvents, with at least one rotor bearing permanent magnets and a stator having coils, in which motor position sensors for ascertaining a commutating time are arranged in the stator.

Such electric motors are often referred to as electronically commutated DC motors and are used, for example, in fuel tanks for driving a fuel pump. If the coils are arranged in the stator, the electric motor does not require any carbon brushes for the transmission of electrical energy. The electric motor is consequently distinguished as an inexpensive drive with a long service life in the lower and medium power ranges. Hall sensors are generally used as position sensors. The Hall sensors have semiconductor chips with terminal contacts. The semiconductor chips and the terminal contacts are usually sheathed in plastic. The disadvantage of the known position sensors is that the semiconductor chips are of a very complex construction due to their sheathing. Furthermore, the semiconductor chips, soldering points of the terminal contacts are not solvent-resistant in the long term. Plastic sheathings also cannot offer adequate protection against the diffusion of solvents, so that, in spite of sheathing, the semiconductor chips are attacked by the solvents. These occurrences of damage to the semiconductor chips mean that the position of the rotor can no longer be reliably sensed by the position sensor.

The invention is based on the problem of designing an electric motor of the type stated at the beginning in such a way that it can be produced as

inexpensively as possible and has a very high resistance to solvents.

5 This problem is solved according to the invention by the position sensors having an electrical conductor which is induced by a moving magnetic field to generate a signal and by the electrical conductor being produced integrally with connecting leads.

10 This design obviates the need for the position sensor of the electric motor according to the invention to have any sheathing, since an electrical conductor, such as a copper wire for example, is not attacked by solvents. As a result, particularly inexpensive position sensors can be used in the electric motor according to the invention. The integral production of  
15 the electrical conductor with the connecting leads also allows the position sensor to be fitted very easily and not to require any solvent-resistant soldering points. The electric motor according to the invention can consequently be produced particularly inexpensively and  
20 has a very high resistance to the solvents. A further advantage of this design is that the position sensor can be arranged very close to the magnet of the rotor, so that the position of the rotor can be determined particularly exactly.

25 The connecting leads of the position sensor could, for example, be screw-connected to continuing leads, to avoid soldering points which are not solvent-resistant. However, the fitting of the electric motor according to the invention is made even easier if the  
30 connecting leads of the position sensor are led to a solvent-free space. In the case of the electric motor intended for driving the fuel pump arranged in the fuel tank of a motor vehicle, the connecting leads can consequently be led to outside the fuel tank.

35 According to another advantageous development of the invention, the position of the rotor can be determined particularly exactly if the electrical conductor is designed as a coil. For this purpose, the

coil may be arranged between the phase windings of the stator.

At particularly low rotational speeds of the rotor, the position of the rotor can be easily  
5 determined according to another advantageous development of the invention if the electrical conductor is designed as a pulse wire arranged transversely with respect to the movement of the magnet poles of the rotor.

10 For reasons of space, it is often not possible to arrange the position sensor within the coils of the stator. According to another advantageous development of the invention, the position sensor can be arranged at a position remote from the permanent magnets of the  
15 rotor if the rotor has position magnets arranged away from its permanent magnets and opposite the position sensor. This also makes it possible to avoid a falsification of the signals of the position sensor due to electric currents flowing in the coils of the  
20 stator. Furthermore, it is possible to arrange in the electric motor according to the invention more position magnets than the rotor has permanent magnets. This allows the position of the rotor to be determined particularly exactly.

25 In a further refinement, a disk which is subdivided into a plurality of regions, the regions being differently magnetized, is arranged instead of the position magnets.

The invention allows numerous embodiments. To  
30 illustrate their basic principle further, four of these are described below and represented in the drawing, in which:

Figure 1 shows a schematic representation of an electric motor according to the invention,

35 Figures 2 to 4 show further embodiments of the electric motor according to the invention in schematic representations.

Figure 1 schematically shows an electric motor with a housing 1 and a cylindrical rotor 3 arranged



on a rotatably mounted shaft 2. The rotor 3 has a plurality of coils 5 opposite permanent magnets 4 of the rotor 3. The coils 5 are fastened in the housing 1. Position sensors 6 for sensing the position of the rotor 3 are arranged between the coils 5. On the basis of the signals of the position sensors 6, electric current fed to the coils 5 is controlled. The electric motor is often referred to as an electronically commutated DC motor. The position sensors 6 have in each case electrical conductors 8 produced integrally with connecting leads 7 led to outside the housing 1. On the outer side of the housing 1, the connecting leads 7 are connected to terminal contacts 9. At these terminal contacts 9, control electronics (not represented) of the electric motor can be connected. The electrical conductors 8 are wound to form a coil. When there is a rotation of the rotor 3, the permanent magnets 4 generate induction currents within the electrical conductors 8 wound to form the coil. The electrical conductors 9 are produced, for example, from copper wire.

Figure 2 schematically shows a further embodiment of the electric motor, in which the position sensors 6 have electrical conductors 10 designed as pulse wires. The electrical conductors 10 are arranged parallel to the lateral surface of the rotor 3 and are produced integrally with connecting leads 11. As in the case of the electric motor from Figure 1, the position sensors 6 are arranged between the coils 5.

Figure 3 schematically shows a further embodiment of the electric motor, in which a disk 13 having position magnets 12 is fastened on the shaft 2 away from the permanent magnets 4 of the rotor 3. The position sensors 6 are opposite the disk 13 with the position magnets 12 and are consequently located in a position remote from the coils 5. The position sensors 6 have electrical conductors 14 wound to form a coil.

Figure 4 schematically shows a further embodiment of the electric motor, in which the position

[illegible]

**Patent claims**

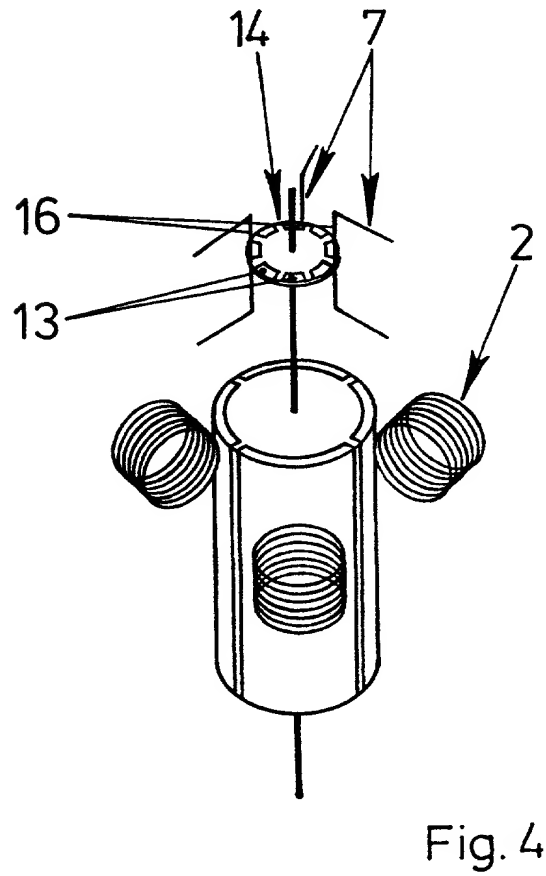
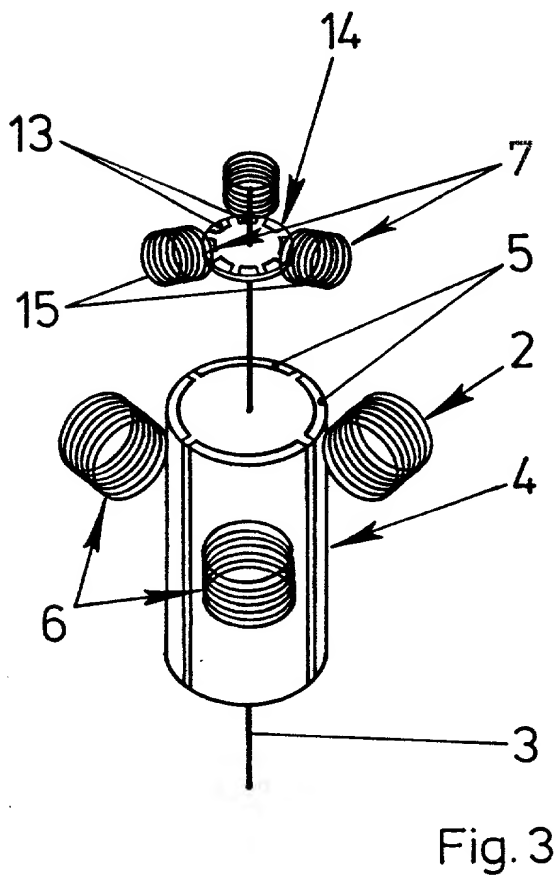
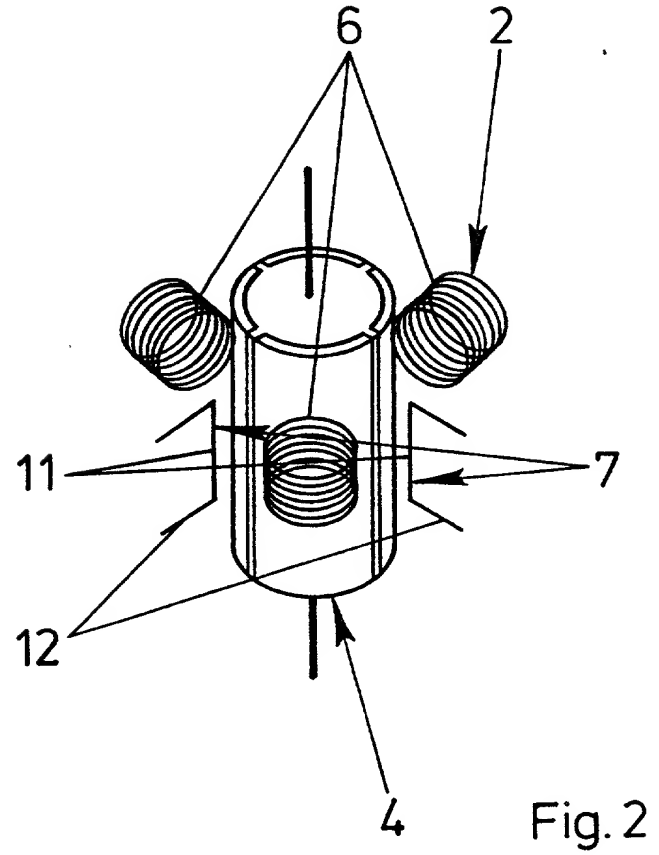
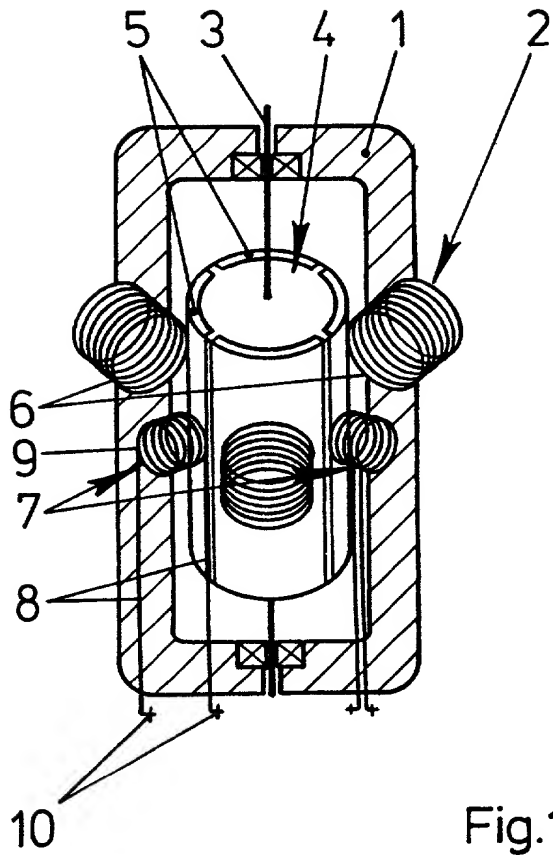
1. An electronically controlled electric motor intended for use in an environment with solvents, with  
5 at least one rotor bearing permanent magnets and a stator having coils, in which motor position sensors for ascertaining a commutating time are arranged in the stator, characterized in that the position sensors (6) have an electrical conductor (8, 10, 14, 15) which is  
10 induced by a moving magnetic field to generate a signal and in that the electrical conductor (8, 10, 14, 15) is produced integrally with connecting leads (7, 11).
2. The electric motor as claimed in claim 1, characterized in that the connecting leads (7, 11) of  
15 the position sensor (6) are led to a solvent-free space.
3. The electric motor as claimed in claim 1 or 2, characterized in that the electrical conductor (8, 14) is designed as a coil.
- 20 4. The electric motor as claimed in at least one of the preceding claims, characterized in that the electrical conductor (10, 15) is designed as a pulse wire arranged transversely with respect to the movement of the magnet poles of the rotor (4).
- 25 5. The electric motor as claimed in at least one of the preceding claims, characterized in that the rotor (3) has position magnets (12) arranged away from its permanent magnets (4) and opposite the position sensor (6).
- 30 6. The electric motor as claimed in at least one of the preceding claims, characterized in that the rotor (3) has a disk (13) which is arranged away from its permanent magnets (4), is in operative connection with the position sensor (6) and has differently  
35 magnetized regions.

## Abstract

Electronically controlled electric motor intended for  
use in an environment with solvents

An electronically controlled electric motor has, as position sensors (6), coils (5) which are arranged in a stator (2) and opposite permanent magnets (4) of a rotor (3). The coils (5) are produced integrally with connecting leads (7). This allows the electric motor to be used in an environment with solvents. Furthermore, the electric motor is of a particularly inexpensive design.

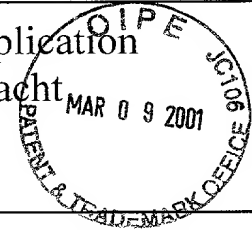
(Figure 1)



09/719594

Declaration and Power of Attorney for Patent Application  
Erklärung für Patentanmeldungen mit Vollmacht

German Language Declaration



Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

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**ELECTRONICALLY CONTROLLED  
ELECTRIC MOTOR INTENDED FOR USE IN  
AN ENVIRONMENT WITH SOLVENTS**

deren Beschreibung hier beigefügt ist, es sei denn (in diesem Falle Zutreffendes bitte ankreuzen), diese Erfindung.

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As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**ELECTRONICALLY CONTROLLED  
ELECTRIC MOTOR INTENDED FOR USE IN  
AN ENVIRONMENT WITH SOLVENTS**

(Title of the Invention)

the specification of which is attached hereto unless the following box is checked:

- ☒ 12/13/00  
was filed on \_\_\_\_\_ as United States  
Application No. 09/719594 .

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

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Prior Foreign Applications  
(Frühere ausländische Anmeldungen)  
(Tag/Monat/Jahr der Anmeldung)  
PCT/EP 00/02509

_____	EP
(Number)	(Country)
(Nummer)	(Land)

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Ich beanspruche hiermit Prioritätsvorteile unter Title 35, US-Code, §119(e) aller US-Hilfsanmeldungen wie unten aufgezählt.

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(Aktenzeichen)	(Anmeldetag)

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(Application No.)	(Filing Date)
(Aktenzeichen)	(Anmeldetag)

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I hereby claim foreign priority under Title 35, United States Code, §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior foreign applications

PCT/EP 00/02509

03/22/2000 ☒ (Day/Month/Year Filed)

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100694635-1



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Robert J. Depke (Reg. No. 37,607), Victor S. de Gyarfas (Reg. No. 40,583), Douglas M. Eveleigh (Reg. No. 43,426), Susan D. Reinecke (Reg. No. 40,198), Robert S. Rigg (Reg. No. 36,991), Deborah Schavey Ruff (Reg. No. 33,770), Donald W. Rupert (Reg. No. 29,974), Daniel H. Shulman (Reg. No. P45,106), Richard A. Speer (Reg. No. 17,930), Steven G. Steger (Reg. No. 40,185), Wayne L. Tang (Reg. No. 36,028), David M. Thimmig (Reg. No. 36,034), Michael O. Warnecke (Reg. No. 24,345) and William J. Robinson (Reg. No. 29,430)

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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: (list name and registration number)

All registered members of the firm of Mayer, Brown & Platt, P.O. Box 2828, Chicago, IL 60690, including:

Robert J. Depke (Reg. No. 37,607), Douglas M. Eveleigh (Reg. No. 43,426), Susan D. Reinecke (Reg. No. 40,198), Robert S. Rigg (Reg. No. 36,991), Deborah Schavey Ruff (Reg. No. 33,770), Donald W. Rupert (Reg. No. 29,974), Daniel H. Shulman (Reg. No. P45,106), Richard A. Speer (Reg. No. 17,930), Steven G. Steger (Reg. No. 40,185), Wayne L. Tang (Reg. No. 36,028), David M. Thimmig (Reg. No. 36,034), Michael O. Warnecke (Reg. No. 24,345) and William J. Robinson (Reg. No. 29,430)

Send Correspondence to:

Robert J. Depke

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Frank KUEHNEL

Full name of sole or first inventor

Frank Kuehnel 12.1.2001

Inventor's signature

Date

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GERMANY

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Wolfgang WARNKE

Full name of second joint inventor, if any

Wolfgang Warnke 18.01.2001

Inventor's signature

Date

GERMANY

Residence

GERMAN

Citizenship

EISFELD 7, D-37293, HERLESHAUSEN

DEUTSCHLAND, GERMANY

Post Office Address

# Declaration and Power of Attorney for Patent Application

## Erklärung für Patentanmeldungen mit Vollmacht

### German Language Declaration

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**ELECTRONICALLY CONTROLLED  
ELECTRIC MOTOR INTENDED FOR USE IN  
AN ENVIRONMENT WITH SOLVENTS**

deren Beschreibung hier beigefügt ist, es sei denn (in diesem Falle Zutreffendes bitte ankreuzen), diese Erfindung.

- ☐ wurde angemeldet am \_\_\_\_\_ unter der US-Anmeldenummer oder unter der Internationalen Anmeldenummer im Rahmen des Vertrages über die Zusammenarbeit auf dem Gebiet des Patentwesens (PCT) \_\_\_\_\_ und am \_\_\_\_\_ abgeändert (falls zutreffend).

Ich bestätige hiermit, daß ich den Inhalt der oben angegebenen Patentanmeldung, einschließlich der Ansprüche, die eventuell durch einen oben erwähnten Zusatzantrag abgeändert wurde, durchgesehen und verstanden habe.

Ich erkenne meine Pflicht zur Offenbarung jeglicher Informationen an, die zur Prüfung der Patentfähigkeit in Einklang mit Titel 37, Code of Federal Regulations, §1.56 von Belang sind.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**ELECTRONICALLY CONTROLLED  
ELECTRIC MOTOR INTENDED FOR USE IN  
AN ENVIRONMENT WITH SOLVENTS**

(Title of the Invention)

the specification of which is attached hereto unless the following box is checked:

- ☐ was filed on \_\_\_\_\_ as United States Application No. \_\_\_\_\_

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

# GERMAN LANGUAGE DECLARATION

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäß Title 35, US-Code, §119(a)-(d), bzw. §365(b) aller unten aufgeführten Auslandsanmeldungen für Patente oder Erfinderurkunden, oder §365(a) aller PCT internationalen Anmeldungen, welche wenigstens ein Land ausser den Vereinigten Staaten von Amerika benennen, und habe nachstehend durch ankreuzen sämtliche Auslands-anmeldungen für Patente bzw. Erfinderurkunden oder PCT internationale Anmeldungen angegeben, deren Anmeldetag dem der Anmeldung, für welche Priorität beansprucht wird, vorangeht.

Prior Foreign Applications  
(Frühere ausländische Anmeldungen)  
(Tag/Monat/Jahr der Anmeldung)

PCT/EP 00/02509	EP
(Number)	(Country)
(Nummer)	(Land)
(Number)	(Country)
(Nummer)	(Land)

Ich beanspruche hiermit Prioritätsvorteile unter Title 35, US-Code, §119(e) aller US-Hilfsanmeldungen wie unten aufgezählt.

(Application No.) (Aktenzeichen)	(Filing Date) (Anmeldetag)
(Application No.) (Aktenzeichen)	(Filing Date) (Anmeldetag)

Ich beanspruche hiermit die mir unter Title 35, US-Code, §120 zustehenden Vorteile aller unten aufgeführten US-Patentanmeldungen bzw. §365(c) aller PCT internationalen Anmeldungen, welche die Vereinigten Staaten von Amerika benennen, und erkenne, insofern der Gegenstand eines jeden früheren Anspruchs dieser Patentanmeldung nicht in einer US-Patentanmeldung, bzw. PCT internationalen Anmeldung in einer gemäß dem ersten Absatz von Title 35, US-Code, §112 vorgeschriebenen Art und Weise offenbart wurde, meine Pflicht zur Offenbarung jeglicher Informationen an, die zur Prüfung der Patentfähigkeit in Einklang mit Title 37, Code of Federal Regulations, §1.56 von Belang sind und die im Zeitraum zwischen dem Anmeldetag der früheren

I hereby claim foreign priority under Title 35, United States Code, §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior foreign applications

PCT/EP 00/02509

03/22/2000 ☒ (Day/Month/Year Filed)

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s), or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: *(list name and registration number)*  
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